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None

(58) Field of search
B3C
B3B
Selected US specifications from IPC sub-class B23B

# (54) Machine tool

(57) A drill press (10) includes a drive head (16) carried in guideways of a frame (14) for controlled movement to and from a work surface or workpiece. A toothed rack (42) is mounted on the drive head (16) and engages a pinion gear (44) carried on a rotatably mounted shaft (46) in the frame for moving the drive head (16). A feed handle (18) includes a square-ended shaft (52) that can be received in an axial square opening (50) through the pinion shaft (46) to allow the feed handle to be mounted on either side of the machine. The squared-ended shaft (46) includes a releasable spring-loaded detent mechanism (62, 64, 70) to releasably secure the feed handle (18) in either end of the pinion shaft (46). As an alternative to the use of the feed handle (18), a standard square-drive automotive rachet wrench (78) and an extension (80) may be inserted in either end of the pinion shaft (46) for rotation thereof. While square-drive couplings are preferred, other feed drive configurations, including hexagonal or the like, may be employed.

FIG. 3

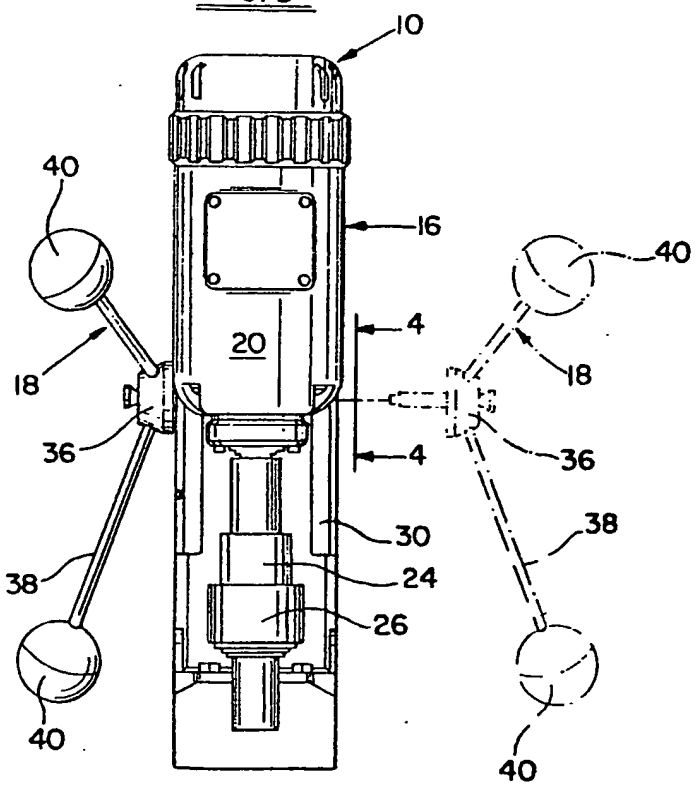


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FIG. 1

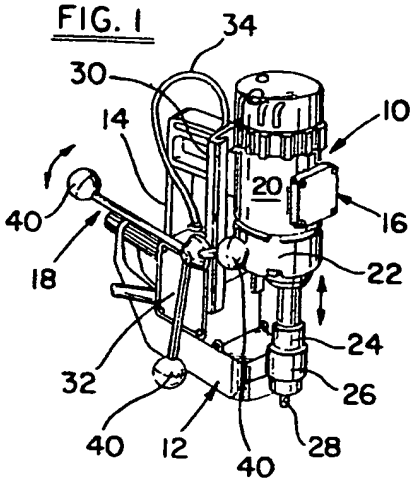



FIG. 2

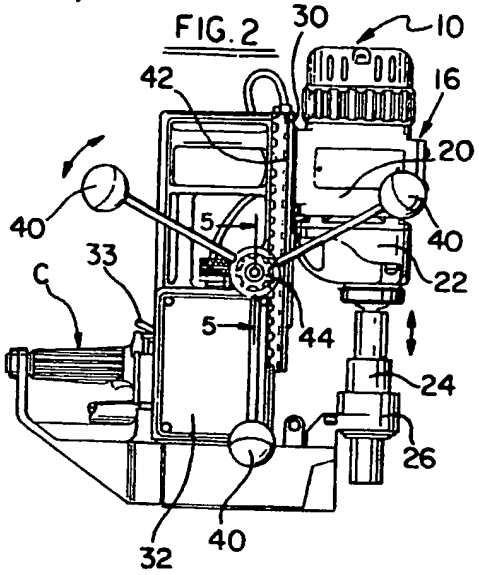



FIG. 3

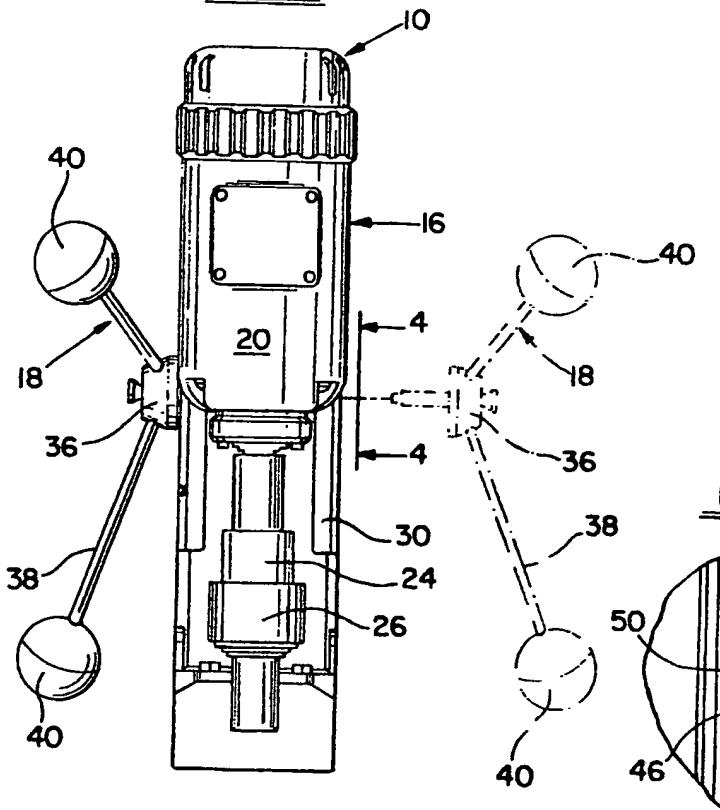



FIG. 4

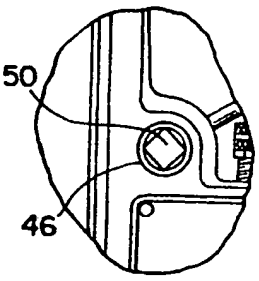


FIG. 5

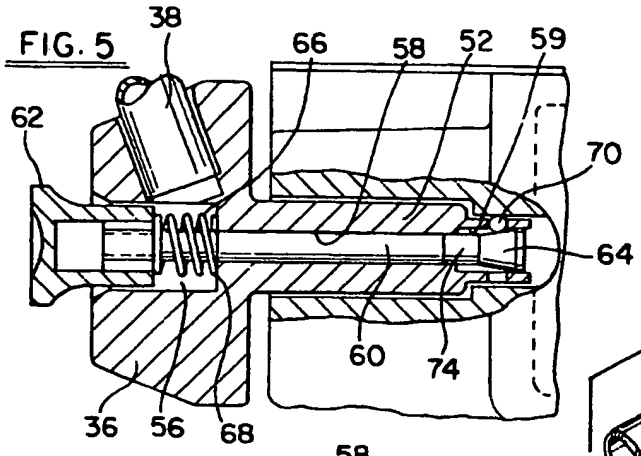



FIG. 9

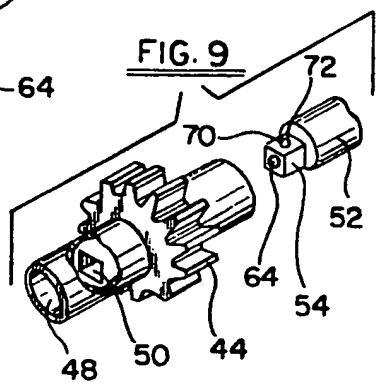



FIG. 6

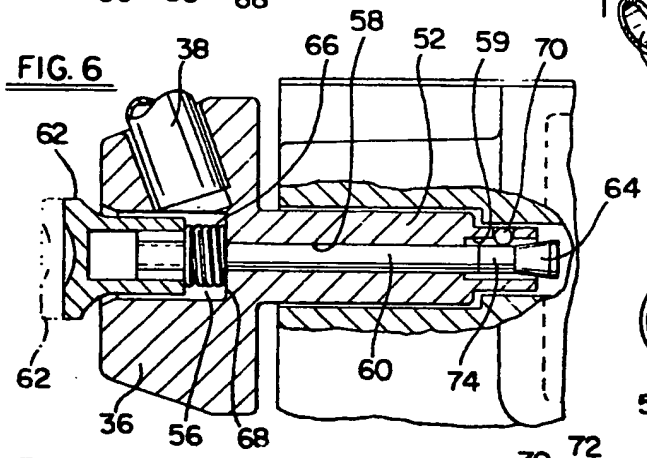



FIG. 11

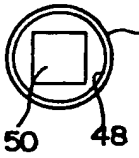



FIG. 12

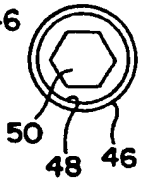



FIG. 7

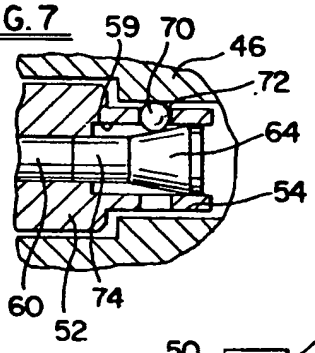
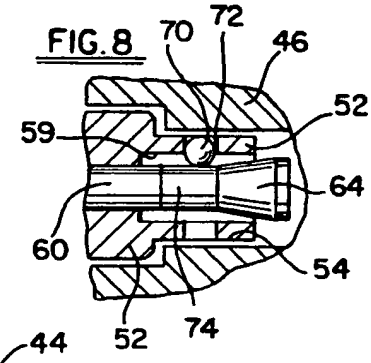



FIG. 8



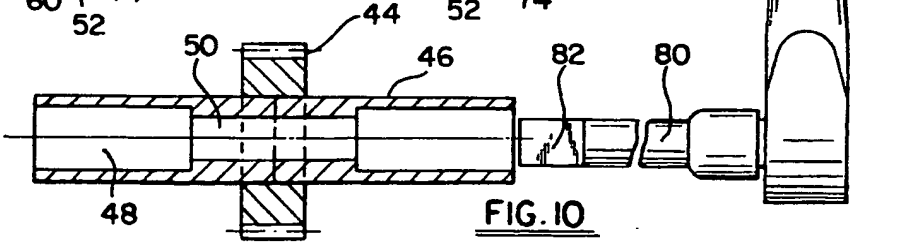




FIG. 10

SPECIFICATION

**Machine tool**

This invention relates to machine tools, particularly drilling machines such as drill presses.

A conventional drill press arrangement includes a frame that carries a drive head mounted in guideways for controlled movement along a tool axis. The drive head typically includes a rotatable spindle that is coupled to an output element, such as a chuck, which accepts a rotary cutting tool, usually a twist drill or end mill. The drive head can include a motor mounted for movement in the guideway, or the motor can be mounted on the frame and connected to the drive head by a pulley and belt arrangement. A toothed gear rack is secured to the drive head and engages a pinion gear rotatably mounted in the frame. A feed handle assembly is connected to the pinion gear so that rotation of the feed handle and the connected pinion gear causes the drive head to advance toward or retract away from a work surface or workpiece. In its usual form, the feed handle has a hub that is secured to one end of the shaft that carries the pinion gear so that the location of the feed handle relative to the machine frame is fixed. Arms may extend from the hub with knobs mounted on the end of each arm to allow convenient manipulation of the feed handle by the drill press operator.

This traditional drill press arrangement is well suited for fixed-site locations where ample clearance can be provided for rotation of the feed handle to control the movement of the drive head and the cutting tool. In certain situations in which the drill press is moved from work site to work site, the traditional drill press feed handle arrangement presents a number of drawbacks.

For example, a class of drilling machines utilize an energizable magnet coil in their base which can be selectively energized to magnetically engage a work surface. Magnetic base machines have found use in repairing large steel structures, such as bridges and ships, where they can be easily moved from one location to another. Where such machines are used in close quarters, the traditional arrangement of the feed handle on one side of the machine can be a limiting factor in the use of the machine. For example, where the machine must be positioned with the feed handle closely adjacent to a wall or other surface, operation of the feed handle can be difficult because of the lack of adequate clearance space.

Accordingly, the purpose of the present invention is to improve the utility of drill presses, and similar machines that have a drive head mounted for controlled movement along an axis by the use of a feed handle, by providing a feed handle that is convertible from one position on the machine to another. Preferably, the feed handle may be selectively attached to the machine on either side, *e.g.*, a left side or a right side.

The present invention, in a preferred embodiment, is also concerned with further increasing the utility of such machines by providing for the movement of the drive head to be effected, when desired, without use of the feed handle but by use of an auxiliary feed handle or similar tool.

Therefore, according to the present invention there is provided a machine tool comprising drive means for driving a rotary cutting tool; support means for mounting said drive means for controlled movement along an axis; motion converting means coupling said drive means and said support means, said motion converting means including a plurality of rotary input positions, whereby a rotary input to said motion converting means at any one of said rotary input positions causes controlled movement of said drive means along said axis; a feed handle for coupling to said motion converting means for providing said rotary input thereto; and means for releasably coupling said feed handle to any one of said rotary input positions.

The means for releasably coupling preferably comprises first and second coupling means interengageable in a torque transmitting relationship. The first coupling means may comprise a projection, for example on the feed handle, and the second coupling means may comprise an opening for receiving the projection. Preferably each of the rotary input positions has such an opening.

A drilling or similar machine in accordance with the present invention may include a frame having guideways for receiving the drive means, for example a drive head, for controlled movement in the guideways along a tool axis toward or away from a work surface or work piece. The motion converting means comprises a rotary to linear motion converting mechanism, preferably in the form of a rack and pinion, and couples the drive head and frame.

The operator manipulatable feed handle may be provided with a stub shaft configured to detachably engage a pinion shaft on either side of the drilling machine, so that the handle can be attached to the machine in one of a plurality of positions, such as a right side position or a left side position of the machine.

In the preferred embodiment of the invention, the feed handles includes a central hub having a square-ended stub shaft that is received within a square opening formed in the pinion shaft. A detect ball is preferably provided in the square-ended stub shaft and may cooperate with a spring-loaded detent shaft to releasably maintain the feed handle in an engaged position with the pinion shaft. The feed handle can thus be mounted on one side of the machine or the other as required to increase the utility of the drilling machine in confined spaces. If desired, the feed handle can be removed and a square-drive tool, such as a square-drive rachet wrench and extension, can be engaged with the machine in one of the plurality of positions to also control the motion of the drive head.

The present invention advantageously increases the utility of drilling and similar machines, that have a drive head mounted for controlled movement along an axis, by allowing the drive head to be controlled by a feed handle that can be conve-

niently mounted in any one of a plurality of positions, such as on either side of the drilling machine; in the alternative, the drive head may be controlled by an auxiliary feed handle in the form of a common automotive type rachet wrench or the equivalent. The torque transmitting coupling between the feed handle and the machine may be defined by any suitable coupling including complementary polygonal projections and cooperating recesses or openings such as square, hexagonal, or the like drive configurations.

By way of example, a preferred embodiment of the invention will now be described in greater detail with reference to the accompanying drawings, in which:

*Figure 1* is an isometric view of a convertible handle drilling machine in accordance with the present invention with the feed handle mounted on the left side of the machine;

*Figure 2* is a side elevational view of the drilling machine of Figure 1 with selected portions broken away to illustrate a rack and pinion gear arrangement;

*Figure 3* is a front elevational view of the drilling machine of Figures 1 and 2 with the feed handle shown in one position in solid line illustration on the left side of the machine and in another position on the right side of the machine in broken line illustration;

*Figure 4* is a detail view, taken along line 4-4 of Figure 3, of the end of a pinion shaft;

*Figure 5* is a partial cross section view, taken along line 5-5 of Figure 2, illustrating the feed handle hub and a releasable detent mechanism by which the feed handle may be removed from the drilling machine;

*Figure 6* is a cross sectional view of the feed handle hub and detent mechanism of Figure 5 with a detent shaft in a depressed position to allow release of a detent ball and withdrawal of the feed handle from the drilling machine;

*Figure 7* is an enlarged detail view of the end of a detent shaft shown in Figure 5;

*Figure 8* is an enlarged detail view, similar to that of Figure 7, of the end of the detent shaft shown in Figure 6;

*Figure 9* is an isometric view of the pinion gear secured to a mounting shaft which is partly broken away to show a square central opening;

*Figure 10* is a partial cross sectional view of the pinion gear and shaft engaged by an automotive type rachet wrench and extension by which the drilling machine may be controlled in lieu of the feed handle;

*Figure 11* is a detail view of a preferred square coupling arrangement for the pinion shaft and the feed handle; and

*Figure 12* is a detail view of a hexagonal coupling arrangement for the pinion shaft and the feed handle.

A convertible handle drilling machine in accordance with the present invention is illustrated in Figures 1, 2, and 3 and designated generally therein by the reference character 10. As shown, the drilling machine 10 includes a base 12 that contains an electrically energizable magnet coil (not shown), a frame 14 extending upwardly from the base, a drive head 16 mounted on the frame for guided movement along a generally vertical tool axis, and an operator-controllable feed handle 18 for controlling the movement of the drive head. As is known in the art, the magnetic base 12 can be electrically energized to create a magnetic field that draws the base to a work surface

The head 16 includes an electric motor 20 coupled to a gear head 22 and an output element 24 rotatably carried in a bushing 26. A rotary cutting tool, such as a twist drill bit 28, is mounted in the output element 24. The frame 14 includes guideways 30 in which the drive head 16 is mounted for guided movement along a generally vertical tool axis. An electrical component compartment 32 is mounted in the frame 14 and contains electrical circuit components for controlling electrical current to the motor 20 and the magnetic base 12. An electrical cable 34 extends from the electrical component compartment 32 to the motor 20 for providing electrical power to the motor. A controller "C" is mounted on the frame 14 adjacent the electrical component compartment 32 for controlling the magnetic base 12, and an ON/OFF switch 33 is provided for controlling the operation of the motor 20.

As illustrated in Figure 3, the feed handle 18 is detachable from the drilling machine 10 between the solid line position illustrated in Figures 1, 2, and 3 and the dotted line position of Figure 3 to thus provide a convertible handle machine in which the rotary input of the feed handle can be provided on either side of the machine. The feed handle 18, as shown in Figure 4, is designed to engage an end of a pinion shaft, described more fully below. The feed handle 18 includes a central hub 36 with three arms 38 extending radially from the hub and terminated with knobs 40. As shown in Figure 2, a toothed rack 42 is mounted on the drive head 16 and engages a pinion gear 44 that is rotatably mounted on the frame 14 so that rotation of the pinion gear will cause the drive head 16 to move along the generally vertical tool axis in Figure 2. As shown in Figure 9, the pinion gear 44 is secured to a pinion shaft 46 that is rotatably mounted in suitable journals or bearings (not shown) in the frame 14. As shown in the cross sectional view of the pinion shaft 46 in Figure 10 and the end view of Figure 11, the pinion shaft 46 is provided with cylindrical counterbores 48 on its opposite ends and a coaxial square opening 50 through its mid-section so that the square opening is accessible from the opposite ends of the pinion shaft 46.

As shown in Figures 5 and 6, the hub 36 of the feed handle 18 includes an axially extending stub shaft 52 that is terminated by a square end 54 (see Figures 8 and 9). The hub 36 includes a counterbore 56 and a coaxial bore 58 that extends the entire length of the stub shaft 52 and terminates with a smaller counterbore 59. A detent shaft 60 is mounted within the coaxial bore 58 and includes, on the one end, a depressable push button 62 and, on the other end, a frusto-conical head 64 located

in the counterbore 59. the frusto-conical head 64 includes a conical surface that diverges outwardly and to the right in Figures 5-8. A helical coil spring 66, in compression, is mounted on the detent shaft 60 in the counterbore 56 between a shoulder 68 and the push button 62 to urge the detent shaft 60 to the left in Figure 5. A detent ball 70 is retained in a bore 72 formed in the flat wall section of the square end 54 and is controlled by the axial position of the frusto-conical head 64.

The convertible nature of the feed handle 18 can be best appreciated from a comparison of Figures 5 and 6 and Figures 7 and 8. As shown in Figure 5, when the feed handle 18 is coupled to one end of the pinion shaft 46, the stub shaft 52 is received in the counterbore 48 with the square end 54 received in the square opening 50 in a torque transmitting engagement. In the normal position, the coil spring 66 resiliently urges the detent shaft 60 to the left in Figure 5 to cause the inclined surface of the frusto-conical head 64 to urge the detent ball 70 into frictional engagement with a wall surface (Figure 7) of the square opening 50. The feed handle 18 is thus mechanically coupled and held in a torque transmitting relationship to the pinion shaft 46 through the square drive connection with the detent ball 70 normally preventing unintentional removal of the handle 18.

When it is desired to remove the feed handle 18 from the drilling machine 10, and as shown in Figure 6, the push button 62 is manually depressed against the force of the spring 66 to displace the detent shaft 60 to the right. As shown in the detail of Figure 8, the frusto-conical head 64 is also displaced to the right to allow the detent ball 70 to disengage the wall of the square opening 50 of the pinion shaft 44 and move into a clearance space created by a reduced diameter section 74 of the detent shaft 60. The feed handle 18 can now be removed from one side of the drilling machine 10 and conveniently re-installed on the other side of the machine.

In some cases, particularly when using the machine in a confined space, it may not be practical or desirable to use the feed handle 18 to control the motion of the drive head 16. In these cases, a square drive tool, such as the automotive type rachet wrench 78 (see Figure 10) and co-operating extension 80 having a square-ended tip 82, may be used to engage the square opening 50 of the pinion shaft 44 from either side of the drilling machine 10.

In the preferred embodiment, a square drive connection is preferred although other drive configurations, including the hexagonal opening 50 of Figure 12, are likewise suitable. Where a hexagonal opening is employed, a hex wrench may be used in lieu of the disclosed square drive tool to control movement of the drive head. Additionally, the relationship of the torque transmitting projection and the cooperating recess can be reversed, that is, the recess or opening can be provided in the feed handle assembly and the torque transmitting projection can be associated with the pinion gear. While the present invention has been described in the content of a magnetic base drilling machine, the convertible feed handle arrangement is well suited for other types of machines having a drive head that can be fed along an axis.

Thus is will be appreciated from the above that the present invention provides a highly effective convertible handle machine tool.

It will be apparent and is contemplated that modification and/or changes may be made in the illustrated embodiment without department from the invention. Accordingly, it is expressly intended that the foregoing description and accompanying drawings are illustrative of preferred embodiments only, not limiting, and that the scope of the present invention is defined by teh appended claims.

CLAIMS

1. A machine tool, comprising:
drive means for driving a rotary cutting tool;
support means for mounting said drive means for controlled movement along an axis;
motion converting means coupling said drive means and said support means, said motion converting means including a plurality of rotary input positions, whereby a rotary input to said motion converting means at any one of said rotary input positions causes controlled movement of said drive means along said axis;
a feed handle for coupling to said motion converting means for providing said rotary input thereto; and
means for releasably coupling said feed handle to any one of said rotary input positions.

2. The machine tool of Claim 1, in which said means for releasably coupling comprises first and second coupling means interengageable in a torque transmitting relationship. 3. The machine tool of Claim 2, in which said first coupling means comprises a projection, and said second coupling means comprises an opening for receiving said projection.

4. The machine tool of Claim 3, in which said projection has a polygonal configuration and said opening has a complementary shape.

5. The machine tool of Claim 4, in which said polygonal configuration is a square.

6. The machine tool of Claim 4, in which said polygonal configuration is a hexagon.

7. The machine tool of any one of Claims 3 to 6, in which said motion converting means comprises a rack and pinion, rotary input to said pinion causing said controlled movement of said drive means along said axis.

8. The machine tool of Claim 7, in which said pinion is secured to a pinion shaft, said pinion shaft having said opening formed therein.

9. The machine tool of Claim 8, in which said projection is formed on said feed handle.

10. The machine tool of any one of Claims 3 to 9, further comprising releasable detent means for releasably securing said projection in said opening.

11. The machine tool of Claim 10, in which said feed handle has a shaft, said projection being formed at one end of said feed handle shaft, and

said releasable detent means comprises a ball element mounted in said one end of said shaft and forceably engageable with a wall surface defining said opening.

12. The machine tool of Claim 11, in which said feed handle shaft is formed with a bore, and said detent means further comprises a detent shaft contained within said bore and cooperating with said ball to cause said ball to forceably engage said wall surface defining said opening.

13. The machine tool of Claim 12, in which said detent shaft has a frusto-conical head at one end, said frusto-conical head having a relatively inclined surface engaging said ball to cause said ball to forceably engage said wall surface.

14. The machine tool of Claim 13, further comprising spring means associated with said detent shaft for resiliently urging said detent shaft in a first direction to cause said ball to forceably engage said wall surface.

15. The machine tool of Claim 8 or 9, in which said projection can be releasably secured in either end of said opening to enable said feed handle to be selectively located on opposite sides of said machine tool.

16. The machine tool of any preceding claim, in which said machine tool is a drilling machine.

17. The machine tool of Claim 16, further comprising an electrically energizable electromagnetic base for magnetically engaging a work surface.

18. A drilling machine substantially as hereinbefore described with reference to the accompanying drawings.

New claims or amendments to claims filed on

Superseded claims

1. A machine tool, comprising:

drive means for driving a rotary cutting tool;

support means for mounting said drive means for controlled movement along an axis;

motion converting means coupling said drive means and said support means, said motion converting means including a plurality of rotary input openings, whereby a rotary input to said motion converting means at any one of said rotary input openings causes controlled movement of said drive means along said axis; and

a feed handle having a projection selectively insertable into any one of said rotary input openings for providing clockwise and anti-clockwise rotary input to said motion converting means.

2. A machine tool as claimed in Claim 1, in which said projection has a polygonal configuration and said opening has a complementary shape.

3. A machine tool as Claimed in Claim 2, in which said polygonal configuration is a square.

4. A machine tool as claimed in Claim 2, in which said polygonal configuration is a hexagon.

5. A machine tool as claimed in any preceding Claim, in which said motion converting means comprises a rack and pinion, rotary input to said pinion causing said controlled movement of said drive means along said axis.

6. A machine tool as claimed in Claim 5, in which said pinion is secured to a pinion shaft, said pinion shaft having said opening formed therein.

7. A machine tool as claimed in Claim 6, in which said projection can be releasably secured in either end of said opening to enable said feed handle to be selectively located on opposite sides of said machine tool.

8. A machine tool as claimed in any preceding Claim, including means for releasably retaining said feed handle in the selected rotary input opening.

9. A machine tool as claimed in Claim 8, wherein said releasably retaining means comprises a ball element mounted in said projection and forceably engageable with a wall surface defining said opening.

10. A machine tool as claimed in Claim 9 and further comprising a shaft which co-operates with said ball to cause said ball to forceably engage said wall surface defining said opening.

11. A machine tool as claimed in Claim 10, in which said shaft has a frusto-conical head at one end, said frusto-conical head having a relatively inclined surface engaging said ball to cause said ball to forceably engage said wall surface.

12. A machine tool as claimed in Claim 11, further comprising spring means associated with said shaft for resiliently urging said shaft in a first direction to cause said ball to forceably engage said wall surface.

13. A machine tool as claimed in any preceding claim, wherein said support means comprises a frame having guideways which, in use, guide said drive means.

14. A machine tool as claimed in any preceding claim, in which said machine tool is a drilling machine.

15. A machine tool as claimed in Claim 14, further comprising an electrically energizable electromagnetic base for magnetically engaging a work suface.

16. A drilling machine substantially as hereinbefore described with reference to the accompanying drawings.

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